

CLAIMS

1. An internal combustion engine comprising:
 - a combustion chamber;
 - 5 first and second inlet valves controlling flow of air into the combustion chamber;
 - first and second exhaust valves controlling flow of combusted gases out of the combustion chamber; and
 - first and second turbo-chargers; wherein:
 - 10 the first turbo-charger is connected to the first inlet valve and the second turbo-charger is connected to the second inlet valve;
 - charge air supplied to the combustion chamber via the first inlet valve is pressurised only by first turbo-
 - 15 charger;
 - charge air supplied to the combustion chamber via the second inlet valve is pressurised only by the second turbo-charger;
 - the first turbo-charger is connected to the first
 - 20 exhaust valve and receives only combusted gases expelled via the first exhaust valve;
 - the second turbo-charger is connected to the second exhaust valve and all combusted gases expelled via the second exhaust valve flow to the second turbo-charger
 - 25 without passing through the first turbo-charger; and
 - valve operating means controls operation of the first inlet valve and first exhaust valve independently from the operation of the second inlet valve and second exhaust valve thereby providing variation in the ratio of the mass of
 - 30 charge air supplied to the combustion chamber via the first inlet valve to the mass of charge air supplied to the combustion chamber via the second inlet valve.

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2. An internal combustion engine as claimed in claim 1 wherein the valve operating means can deactivate the second inlet valve and the second exhaust valve whereby all charge
5 air supplied to the combustion chamber is pressurised by the first turbo-charger and delivered via the first inlet valve.

3. An internal combustion engine as claimed in claim 2 wherein the valve operating means can operate simultaneously
10 the first and second inlet valves and the first and second exhaust valves whereby charge air supplied to the combustion chamber is pressurised by both of the first and second turbo-chargers and delivered via both the first and second inlet valves.

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4. An internal combustion engine as claimed in any one of claims 1 to 3 wherein combusted gases leaving the first turbo-charger are relayed to the second turbo-charger and drive the second turbo-charger jointly with the combusted
20 gases supplied via the second exhaust valve.

5. An internal combustion engine as claimed in any one of claims 1 to 3 wherein combusted gases leaving each of the first and second turbo-chargers are relayed to exhaust
25 without passing through the other turbo-charger.

6. An internal combustion engine as claimed in claim 5 wherein the valve operating means can deactivate the second inlet valve and the second exhaust valve whereby all charge
30 air supplied to the combustion chamber is pressurised by the second turbo-charger and delivered via the second inlet valve.

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7. An internal combustion engine as claimed in any one of the preceding claims wherein the first inlet valve is associated with a first inlet port which imparts to charge
5 air flowing therethrough a flow characteristic different to a flow characteristic imparted to charge air flowing through a second inlet port associated with the second inlet valve.
8. An internal combustion engine as claimed in claim 7
10 wherein the first inlet port imparts to the charge air flowing therethrough a degree of swirl greater than the degree of swirl imparted to charge air flowing through the second inlet port.
- 15 9. An internal combustion engine as claimed in any one of the preceding claims comprising a first intercooler for cooling air pressurised by the first turbo-charger before the air flows into the combustion chamber via the first inlet valve and a second intercooler for cooling air
20 pressurised by the second turbo-charger before the air flows into the combustion chamber via the second inlet valve.
10. An internal combustion engine as claimed in any one of the preceding claims wherein the first turbo-charger is a
25 low pressure turbo-charger and the second turbo-charger is a high pressure turbo-charger.
11. An internal combustion engine as claimed in claim 10 wherein the valve operating means increases flow of exhaust
30 gas to the high pressure turbo-charger and thereby air flow through the high pressure turbo-charger to the second inlet valve during periods of acceleration of the engine.

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12. An internal combustion engine as claimed in claim 10 or
claim 11 wherein the valve operating means with increasing
engine speed and/or load increases flow of exhaust gas to
5 the high pressure turbo-charger and thereby flow of charge
air through the high pressure turbo-charger to the second
inlet valve.

13. An internal combustion engine as claimed in any one of
10 the preceding claims wherein the valve operating means
comprises an electro-hydraulic actuator individual to each
inlet valve and each exhaust valve and controlled by an
electrical controller to vary operation of the valve and
thereby the turbo-chargers having regard to changes in
15 engine operating conditions.

14. An internal combustion engine substantially as
hereinbefore described with reference to and as shown in the
accompanying drawings.